

is a valuable one. But it must be remembered that it is not a personal question, which admits of the simple solution that Mr. Tuckwell can teach science and that Mr. Wilson cannot, but a general one : can science be taught to young boys by the rank and file of science teachers, who are, or will be when they are numerous, neither more nor less able and enthusiastic than the rank and file of classical teachers, very average sort of people? I do not doubt for a moment that my old pupil West can teach little boys science with great advantage, but I doubt very much whether there exist fifty Wests as schoolmasters at any one time in England; and to justify making his practice universal we want to be certain of finding five thousand or fifty thousand such men as teachers. Let it be remembered that very dry and dull men teach classics, and not very badly, while the same men would teach a science class nothing, or worse than nothing.

I wish Dr. Farrar, of Marlborough, would give us his opinion on this whole question. He has had unusual opportunities for forming an opinion and has, no doubt, used them; and I do not know to what conclusions he has arrived.

Mr. Gerstl's proposal to teach facts only—*facts* in *italics*—is truly fearful to me. I fancy an honest stupid man, like some I know, teaching conscientiously what he considers the *facts* of chemistry or botany, or mechanics; and selecting a book the counterpart of Page's "Advanced Text-book of Geology," or Nicolay's "Physical Geography," bristling with *facts*. The facts of botany, in the hands of most teachers, would be a dreary list I suspect. Mr. Gerstl may teach facts alone successfully, but could the rank and file of our profession do the same?

I will most willingly admit, on the contrary, and maintain, that there exists an early science teaching that is at once useful and well-timed: the excitement and gratification of disinterested curiosity about nature; it is to do for a class, if possible, what an intelligent and encyclopaedic father would do for an intelligent child. But how difficult this is for bored and weary schoolmasters! It is so much easier to tell them to get up up pp. *x* to *y* in Oliver or Ansted.

One and only one English book do I know that might almost make a stupid man teach one science well; and that is Mrs. Kitchener's "A Year's Botany" (Rivington's). That happily does not teach facts only; but is the expression of the method of a first-rate teacher in such a form as to enable any one to follow it. And yet I tremble as I mention it, for fear some class of tines shall be ordered to get it and learn the first six pages for their first lesson in botany.

To conclude, therefore, for I will write no more on this matter, what I advise is to interest young boys in science by conversation, by informal teaching, by Natural History Societies, by encouraging collections, aquariums, &c., but not, except in the case of having that rare thing, a genius for the science master (by which I mean a genius for being a master, not a genius for science), to make science a regular subject of class teaching in the lower forms; but to teach the other subjects *well*. Then to bring in science as compulsory on all, first as Physical Geography and Astronomy or Botany, then as Chemistry with laboratory work, and Physics; and after two or three years to let boys choose their own lines. Some will drop it, others will pursue it further. This is one opinion, in brief, on the right place of science in liberal education. Now let us hear what others have to say.

Rugby, April 8

JAMES M. WILSON

NOTES

As might have been expected, Lieut. Cameron met with an enthusiastic reception from a large and distinguished audience at the meeting of the Royal Geographical Society in St. James's Hall on Tuesday night. The hall was crowded, and the Duke

of Edinburgh occupied the chair, surrounded by many eminent geographers. His Royal Highness introduced Lieut. Cameron in a few appropriate and appreciative words. The distinguished explorer gave a narrative of his journey from Zanzibar to the West Coast of Africa, going over ground which is no doubt already pretty familiar to our readers. Sir Henry Rawlinson gave a very clear summary of the work which Lieut. Cameron has accomplished. "He has not been a mere explorer," Sir Henry said, "one of those travellers who carry their eyes in their pockets. He always kept his eyes well about him, and the observations which he made, both of an astronomical and of a physical character, are of extraordinary value. The register of observations which he has brought home, and which are now being computed at the Observatory at Greenwich, promise to be of a most important character. They are astonishingly numerous, elaborate, and accurate, and I have great expectation that one consequence of computing those observations will be that we shall have a definite line laid down from one sea to the other across 20 degrees of longitude, which will serve as a fixed mathematical basis of all future geographical explorations of Equatorial Africa. Among the minor objects achieved by Lieutenant Cameron must be noticed his circumnavigation of the great lake Tanganyika and his discovery of the outlet whereby that lake discharges its waters into the great river Lualaba. Another very important matter is the identification as nearly as possible, not absolutely proved by mathematical demonstration, that the Lualaba is the Congo. One of the main objects of the expedition was to follow down the course of that river so as to prove or disprove the identity of the Lualaba and the Congo. Lieut. Cameron was not able, as he explained to you, to carry out that scheme in its entirety, but he collected sufficient information on the spot to render it a matter, not of positive certainty, but in the highest degree of probability, that the two rivers are one and the same. Another great discovery of his is the determination of a new river system between the valley which he followed of the Lolame, and the scene of Dr. Livingstone's discoveries. This valley, which consists of a large river running through a series of lakes, forms, as he fully believes, and as I also believe, the course of the true Lualaba. The observations which he has furnished respecting latitude, longitude, and elevation, amount to the extraordinary number of nearly 5,000; and he took as many as 130 or 140 lunar observations on one single spot." The Geographical Society has only done its duty in awarding to Lieut. Cameron "the blue ribbon of scientific geography," its principal gold medal of the year.

THE rules of the French Geographical Society strictly forbid the presentation of a prize to any explorer who has not published the narrative of his discoveries. For this reason the motion for granting a medal to Lieut. Cameron at the anniversary meeting this year, was lost. But in the report and the addresses delivered on that occasion, the admiration of the Society was emphatically expressed. The great medal for 1877 will be granted to Lieut. Cameron, we believe, if the necessary condition of publication shall have been complied with.

THERE was a large gathering last Wednesday evening at the Royal Society Conversazione, which passed off very successfully. One of the most attractive features of these meetings is the instruments and apparatus exhibited; in this respect last Wednesday's meeting was quite equal to any former one. A large proportion of the objects exhibited were connected with Mr. Crookes's recent experiments on light. Among these were the following:—(1) The Torsion Balance. (2) The Turbine Radiometer: (3) Radiometer with the vanes blacked on both sides, showing rotation in either direction according to the way the light falls on them. (4) Radiometer showing the very small amount of residual air which is present. (5) Radiometer show-

ing rotation of the glass envelope when the vanes are held fixed in space. The radiometer carries a magnet on its arms, and is floated on water so as to be free to move. (6) Radiometer having inside it a platinum spiral. (7) Radiometer with one vane counterpoised by a mirror, showing method of keeping the steel point from falling off the cup. (8) Radiometer constructed of metal, showing reverse movement on cooling. (9) Bar Photometer, showing the method of balancing one light by another. (10) Heat Engine : A Turbine Radiometer, having ice below and hot air above ; working by difference of temperature. Connected with this subject, Prof. Osborne Reynolds and Dr. Schuster exhibited various apparatus :—(1) Dr. Schuster's experiment, showing that the force discovered by Mr. Crookes reacts on the vessel in which the vacuum is. (2) An experiment, showing that apparently no part of the force is referable to radiation. (3) An instrument to show that the force acts in a direction perpendicular to the hot surface. (4) A photometer which measures the heating effect of light. Among other objects exhibited were :—A series of four Rheotomes, constructed and exhibited by Mr. Apps ; Fossil Elephant Bones, found near London, exhibited by Prof. Tennant ; New method of measuring the position of Absorption-Bands in Spectra, and Specimens of Pigments from Human Hair, illustrated by drawings, exhibited by Mr. H. C. Sorby, F.R.S. ; New Form of Wave Apparatus, invented and exhibited by Mr. C. J. Woodward ; Micro-Geometric Pen, and Medical Battery, with De La Rue's (modified) Chloride of Silver and Zinc Elements, exhibited by Tisley and Spiller ; Dr. Siemens exhibited his Bathometer recently described in NATURE, and an Attraction Meter, an Instrument by which the attraction of Masses is demonstrated ; Mr. Spottiswoode exhibited the largest pair of Nicol's Prisms yet made, and Prof. Tyndall Infusions exposed to Self-cleansed Air ; Mr. J. Browning exhibited a large number of beautifully-constructed apparatus, and Mr. W. F. Stanley a Chronobarometer and Chronothermometer, new instruments for registering Atmospheric Temperature and Pressure ; Edison's Electric Pen, exhibited by Mr. T. D. Clare. Altogether the objects exhibited were varied and of great interest.

AT a meeting of chairmen of sections for organising the conferences in connection with the approaching Loan Collection of Scientific Apparatus at South Kensington which was held on the 10th inst., it was resolved that the conferences should be held on the following dates :—Physics (including Astronomy), May 16, 19, and 24 ; Mechanics (including Pure and Applied Mathematics and Measurement), May 17, 22, and 25 ; Chemistry, May 18 and 23 ; Biology, May 26 and 29 ; Physical Geography, Geology, Mineralogy, and Meteorology, May 30, June 1 and 2. It is proposed that addresses should be delivered on special subjects, and that the more important instruments exhibited should be described and discussed.

A MEMORIAL has been forwarded to the Prime Minister on the subject of University reform at Cambridge. It is signed by eighteen out of the thirty-four professors, and the Master of Trinity, eighty-three resident Fellows, twenty-nine University officers, lecturers, &c., have appended their names. The memorialists call the Prime Minister's attention to the following points contained in a memorial addressed to Mr. Gladstone three years ago :—“ 1. No fellowship should be tenable for life, except only when the original tenure is extended in consideration of services rendered to education, learning, or science, actively and directly, in connection with the University or the Colleges. 2. A permanent professional career should be as far as possible secured to resident educators and students, whether married or no. 3. Provision should be made for the association of the colleges, or of some of them, for educational purposes, so as to secure more efficient teaching, and to allow to the teachers more leisure for private study. 4. The pecuniary and other relations subsisting between the University and the Colleges should be revised, and, if

necessary, a representative Board of University Finance should be organised.” The memorialists then go on to express their conviction that, in the interest of science, learning, and education, the reforms specified are urgently required, and the hope that they will be distinctly recognised in any Bill that may be proposed in reference to this University.

WE learn from the *Times* that the following are the names of the fifteen candidates for the Fellowship of the Royal Society selected by the Council to be recommended to the Society for election. The day fixed for the election is June 1 :—Captain Abney, H. E. Armstrong, Rev. W. B. Clarke, J. Croll, E. Dunkin, Prof. Erichsen, Dr. Ferrier, Colonel Lane-Fox, A. H. Garrod, R. B. Haward, C. Meldrum, E. J. Reed, Prof. Rutherford, R. Swinhoe, and Prof. Thorpe.

WE are much pleased to hear that Lord Walsingham has been appointed a trustee of the British Museum. Lord Walsingham is known to all entomologists as a most zealous collector of and authority upon Microlepidoptera. There being at present but one true biologist among the fifty trustees, the addition of a working naturalist will tend to place the department on a more satisfactory footing.

THE Committee of the German African Society has decided upon making another attempt to explore Central Africa from the West Coast, under the direction of the African traveller, Herr Mohr.

WE understand that Mr. Henry Whitely, jun., so well known for the natural history collections which he has made in Peru, who has recently returned to England, is again about to visit that country, and proposes on this occasion to explore the more northern portion of the Republic. His agent in this country is his father, who resides at 28, Wellington Street, Woolwich.

WE have received the prospectus of “A Monograph of the Cinniridæ, or Family of Sun-birds,” by Capt. G. E. Shelley, F.Z.S., the author of “A Handbook to the Birds of Egypt,” &c. The work is to be issued in quarto-sized guinea parts, about twelve in number, each containing ten plates. The plates will be from the pencil of Mr. Keulemans ; and the whole will be published as rapidly as their proper execution will permit. The author has, for some time past, been engaged in collecting Sun-birds, and has taken the opportunity of studying them mostly in a state of nature in both Western and Southern Africa.

IT is stated that Prof. Andrews of the Queen's College, Belfast, will probably be President of the British Association in 1877.

DR. JAMES RISDON BENNETT, F.R.S., has been elected President of the Royal College of Physicians, London.

THE April number of the *New Quarterly Magazine* contains, among other articles of general interest, a paper by the Hon. W. H. Drummond, author of “The Large Game of South Africa,” on some incidents of African travel.

“ ON opening his letters last week,” the *British Medical Journal* states, “ Prof. Huxley found in one of them a cheque for one thousand pounds, sent by Mr. Thomason, of Manchester, in the name of his lately deceased father, who was a great admirer of Prof. Huxley, and highly appreciated his great achievements in furtherance of our knowledge of the science of life.”

WE have much satisfaction in noting that General Myer, Washington, U.S., has resolved to publish, in the *Bulletin of International Meteorological Observations*, the barometrical observations made at all stations 1,000 feet high and upwards, in two columns, one column giving, along with the height, the results reduced to 32° and corrected for instrumental errors only ; and

the other column giving the same reduced to sea-level. This mode of publishing the observations will, it is evident, furnish the materials for the discussion of important questions of an international character, which could not be attempted if the observations at the higher stations were published only as reduced to sea-level pressures.

IN No. 13 of the *Journal d'Hygiène*, Dr. de Pietra Santa urges with well-timed earnestness the importance to medical men of keeping steadily in view the two-fold function of climatology, which is, in the first place, to collect, by means of accurate instruments and simple methods, regular meteorological observations; and in the second place, to observe and study carefully the influence of these phenomena in their physiological and pathological relations. In the latter case the attention must be directed to types and sequences of weather which meteorologists have scarcely yet made subjects of investigation.

M. BALARD, whose death we announced last week, was born at Montpellier, Sept. 2, 1802. When quite young he manifested a strong passion for reading and study. He was early attracted to chemistry and physics, and while still young was made assistant *préparateur* and then *préparateur* in chemistry to the Faculty of Sciences. At the age of twenty-four years he discovered the element Bromine, and about 1833 was appointed Professor of Physics to the Montpellier School of Pharmacy and Professor of Chemistry to the Faculty of Sciences. He manifested great perseverance and energy in his researches on the utilisation of sea-water for obtaining various saline bodies, and it was while at Montpellier as professor that he made his fine experiments on hypochlorous acid and amylic alcohol. In 1843 he succeeded M. Thénard at the Sorbonne, and in 1846 he was, besides, appointed Superintendent of Lectures at the Upper Normal School. In both positions he acquired a high reputation for his solid instruction and his eminent qualities as a professor. In 1854 he was appointed Professor of General Chemistry at the Collège de France, a post which he held till his death. He shortly after quitted his position at the Sorbonne to become Inspector-General of Superior Education. In this capacity he never lost an opportunity of impressing upon teachers the great importance of introducing experimental science into schools; the want of apparatus he considered no difficulty, as for such simple experiments as are required in a school, the teacher, he thought, might easily devise his own apparatus. In 1846 he was made a member of the Academy of Sciences, and other well-deserved honours were awarded him. M. Balard's efforts and discoveries were mainly directed to the economic applications of science, and in this respect he has done much valuable work; and in the future his researches in the utilisation of sea-water may probably turn out to be of even greater practical value than they have hitherto been. M. Balard was a man who made many friends, was warm-hearted and benevolent, and was loved and respected by all who knew him. He has left no written work behind him, but his personal influence in the advance of science in France has been great.

MR. TORRENS has given notice that on April 24 he will ask the Prime Minister if the Government will give effect to the report of the Civil Service Commissioners recommending an improvement in the condition of the staff of the British Museum.

WE are glad to know that the idea has been broached in New Zealand and Australia, though in a very quiet way, of a union between the various Australian colonies for the prosecution of Antarctic exploration. The idea seems to have been suggested by the action of the mother-country in sending out the Arctic expedition, and we hope it may grow and take substantial shape. It seems to us that it would be a very proper and creditable thing for the Australian colonies to take up Antarctic exploration as their special department.

A CORRESPONDENT, Mr. F. Green, writing from Cannes, France, states that on the 8th instant, for the first time this year, he heard the Cuckoo in a valley amongst mountains sixteen miles to the westward of that place. The first time last year that he heard it in the same neighbourhood was on the 10th of April.

ON April 2 at 5.55 A.M., an earthquake was felt at Berne. Two movements took place from east to west. The duration at was two seconds; doors were opened, and church bells were rung by the shocks. In Neufchâtel a strong detonation was heard; the oscillation was very strong in the lowest part of the city, and clocks struck the hour before the appointed time. Persons who were in the streets declared that warm wind was blowing for some seconds. A few hours afterwards a rain-spout occurred near Mainz, in Rhenish Hesse. A number of houses were struck by a thunderbolt and ignited, many others were flooded by the water falling from the mountains, and people drowned by an instantaneous flood.

THE additions to the Zoological Society's Gardens during the past week include two Chestnut-backed Colies (*Colius castanotus*) from the River Daude, W. Africa, presented by Mr. Henry C. Tait; a Sclater's Muntjac (*Cervulus sclateri*) from China, presented by Mr. W. H. Medhurst; a Mandrill (*Cynocephalus mormon*), two Yellow Baboons (*Cynocephalus babouin*), a Sooty Mangabey (*Cercocebus fuliginosus*), a Monteiro's Galago (*Galago monteiri*), an African Civet Cat (*Viverra civetta*), a Servaline Cat (*Felis servalina*), a Banded Ichneumon (*Harpesites fasciatus*), a Senegal Touracou (*Corythaix persa*), an Angolan Vulture (*Gypohierax angolensis*), a Marabout Stork (*Leptoptilus crumeniferus*), three Broad-fronted Crocodiles (*Crocodilus frontatus*), from W. Africa, presented by Lieut. V. S. Cameron; two Secretary Vultures (*Serpentarius reptiliator*), from S. Africa, deposited; three Wild Boars (*Sus scrofa*), born in the Gardens.

EXPERIMENTAL RESEARCHES ON THE EFFECTS OF ELECTRICAL INDUCTION, FOR THE PURPOSE OF RECTIFYING THE THEORY COMMONLY ADOPTED¹

II.

THE physicist Munck, of Rosenschöld, in his memoir on electrical induction, and on the dissimilation of electricity,² concludes that the opposite electricity of the inductor ought to be regarded as bound, since it is connected with the same inductor and cannot be discharged by the induced body.

M. Riess continues to criticise Lichtenberg.³ He unwittingly admits the existence of dissimulated electricity, since he says "that inductive electricity remains in part dissimulated." He afterwards says, "What has been published on the subject of *bound*, *latent*, *dissimulated* electricity has had a pernicious effect upon the science." But if I am not deceived, it is quite the opposite way, as will be seen from my experiments, by which all the objections urged by Riess against the new theory of electrical induction, published by Melloni and verified by me, are overthrown in the clearest possible manner.

Wüllner says,⁴ "The principal mistake made by Faraday, and on which his reasonings are based, is the hypothesis that induced electricity of the first kind has not the power of acting in an outward direction. It is true that the illustrious English physicist does not explicitly state this hypothesis; but without it his experiments lose all their value." Then according to Wüllner, the absence of tension in induced electricity of the first kind is implicitly admitted by Faraday. We shall see that my experiments prove how little evidence there is of tension.

Verdet is not deceived⁵ when he adduces the contradiction into which the physicists fall who deny that induced electricity of

¹ An Exposition of the Two Theories of Electrical Induction. By M. Paul Volpicelli. Continued from p. 438.

² "Pogg. Ann.," vol. 69, pp. 44 and 223.

³ "Pogg. Ann.," vol. 73, p. 371.

⁴ "Lehrbuch der Experimental Physik," 1st ed., vol. ii., p. 695. (Leipzig, 1863.)

⁵ "Ann. de Chem. et de Phys.," 3rd series, t. 42, p. 374, note 19.